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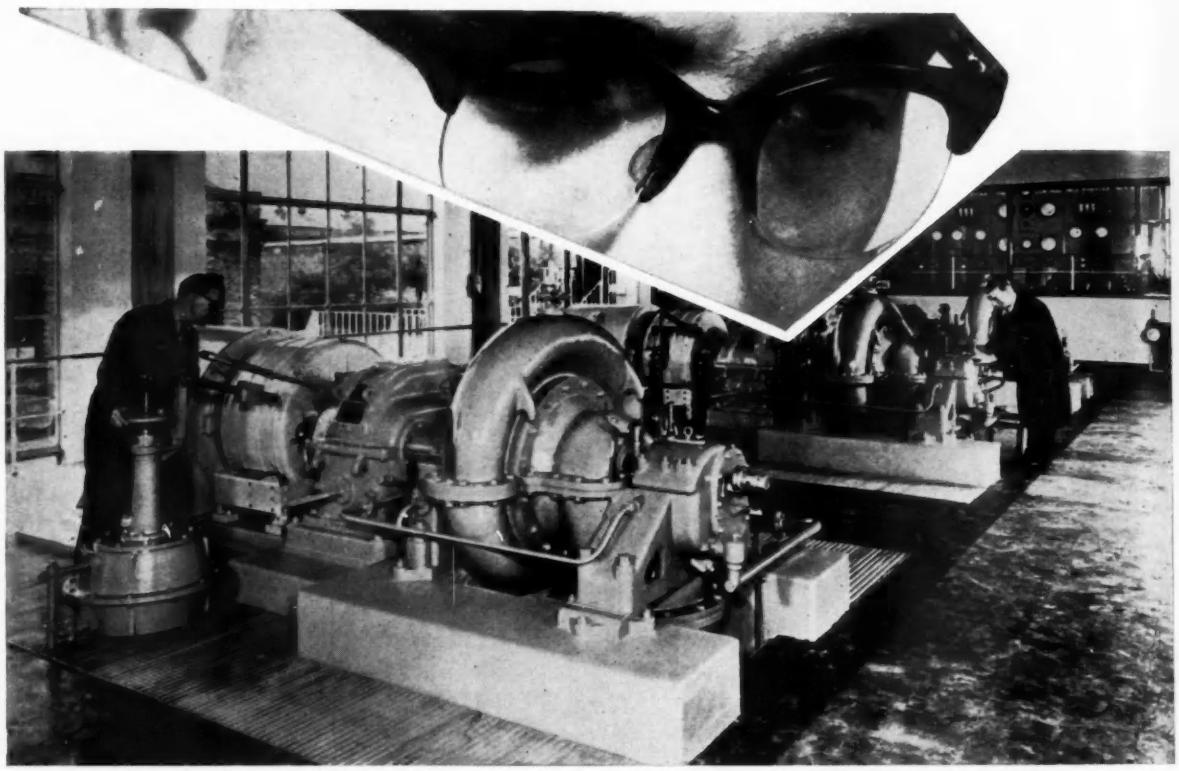

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Gas Journal

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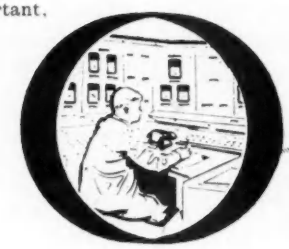

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Gas Journal

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Natural gas will come to Britain

THE announcement by Sir Henry Jones, Chairman of the Gas Council, that the Minister of Power had sanctioned the import of methane from Algeria, has brought to an end a period of speculation during which many in the gas industry will have viewed the problems of reducing the price of gas to the extent recommended by the Parliamentary Select Committee with something like despair.

With the fulfilment of this scheme in two and a half years time there should come a reduction in the costs of gas production, though the comparatively small quantities involved—some 350 mill. therms per annum as a maximum quantity to start with—which amounts to about 12% of total gas sold by the area boards, cannot reduce gas prices to a spectacular degree. It does, however, give an incentive to gas manufacture by the Lurgi process in that it supplies a cheaper means of enrichment.

Sir Henry has announced that the cost of the imported methane at the gasworks will be about 8½d. per therm. Compared with the price of l.p.g. even in bulk, this is a big improvement and should encourage its use for enrichment in other processes as well.

The full scheme includes a 'methane' main to be laid between the Thames and Liverpool with branches to the new Lurgi plant at Coleshill, Sheffield and Reading. We understand that an Eastern Board main is conveniently in the vicinity of the route chosen and should allow the flow of methane eastwards. Are we to assume, then, that the imported gas will have direct access to the North Thames, Southern, West and East Midlands, the North Western and the Eastern Boards? The significance of the branch to Reading may lie, however, in its proximity to potential underground storage capacity in the neighbourhood of Winchester. Clearly then, the scheme as envisaged so far will supply methane to the chief industrial areas of each of the boards through which the main would run, and either this will mean that the number of Lurgi plants will be increased or reforming of the methane itself followed by enrichment will be undertaken.

The laying of this main is in itself of great importance, since it has all the appearance of a national 'back-bone' main and is therefore the first step towards a national grid, and since its route so nearly coincides with Dr. Burns' London to Manchester pipeline, here indeed may well be the shape of things to come.

It is understandable that the coal interests in Britain should oppose the project and the sharp reaction to the announcement by the Chairman of the National Coal Board was to be expected. It is our opinion, however, that it would be very unwise and short-sighted of the coal industry to oppose the import of methane to the extent to which we are led to believe it is desirous of doing. The N.C.B. has put forward counter recommendations for increasing coal gasification by further exploitation of the Lurgi process and the building of a series of plants probably in the Midlands.

Although the Lurgi plant is successfully making gas at Westfield and progress in the building of the plant at Coleshill in Warwickshire is satisfactory, there may still be problems to be overcome in the working of very large plants as envisaged by the N.C.B. A figure of 8¼d. a therm has been quoted as the cost of Lurgi gas, but we are uncertain whether this includes enrichment, whereas Sir Henry's figure of 8½d. per therm includes all the processing necessary on the imported methane and its delivery to the particular area board.

The particular usefulness of methane as an enricher should, we would have thought, encourage the extension of the Lurgi process rather than the reverse.

The cost of the installation in Britain, at Canvey Island in the Thames, will be £18 mill., but the costs of the freezing plant and other handling plant in Algeria will be undertaken by an Algerian company, C.A.M.E.L., at a cost of some £14 mill., and the building of the two 28,000-ton tankers in British yards will be by Conch International Ltd., at a cost of at least £7 mill.

At this moment, the British expertise in the technique of liquid gas shipment is unsurpassed anywhere in the world, and it can be reasonably assumed that the French are glad to make full use of it for the sale of methane in Europe. It is understandable therefore that this country should not only want to share in the advantages to be gained from natural gas, but also be fully aware of its bargaining power in fixing its f.o.b. price at the Algerian port.

The modern distribution network

THE organisation of a distribution system must be one of the most important concepts in the working of an area board. We are accustomed to refer to the need to cut the cost of production in gas manufacture and to stress the advantages to be gained from adopting gas-making processes which allow the use of cheaper feed-stocks, make possible modern labour saving methods and realise the advantages of automation. While these ideas are quite sound, when advocating such solutions for a reduction in the price of gas to the consumer we sometimes tend to leave out the very important part played by the distribution engineer. He is responsible for bringing the gas to the consumer and with modern techniques of compression, gas governing and pressure reduction—perhaps even in the consumer's premises—he may well hold the key to some of the production engineers' problems.

It is notable that even as short a time ago as 1949, distribution engineers were laying down limits over which it was not economic to pump gas at pressures which we might consider as paltry today. But with the increase in coal prices, freight charges and labour costs, the laying of longer distance pipelines working at higher pressures has become more attractive than retaining gas production stations of doubtful economic value. We have therefore become accustomed to the idea of an integrated grid system covering most, if not all, the undertakings in a board's area.

For such a far flung, and in many cases somewhat complex, system of gas mains with differing demands for gas at various points at different times of the day or week, to work smoothly and as cheaply as possible, its own internal organisation must be well conceived and kept continuously at concert pitch.

The organisation of such a system, the South Eastern Gas Board's grid-main network, was described recently by Mr. W. E. Medhurst, Assistant Chief Distribution Engineer of the Board, in a paper to the London and Southern Section of the Institution, entitled 'The Organisation and Operation of a Distribution Department,' an abstract of which appears in our current issue.

The area covered by this Board is perhaps as diverse in character as any in England, since included in it are the great urban population of south London, the industrial and commercial loads of north Kent, the residential areas of Surrey, the coastal resorts of the South East, and finally the comparatively sparcely populated inland rural areas of the three counties, Surrey, Kent and Sussex, which it serves.

The obvious gain of the present development of the Board's supply system is that it has made possible the closing down of 30 manufacturing stations in the last five years, the total of which now stands at 14, with 105 holder stations. The area as a whole is divided into seven divisions, five of which are completely and mutually integrated, while the sixth, east Kent, has its own grid system and the seventh, Sussex, is divided in three systems, a major integrated grid on the west of the county, a minor grid centred on Bexhill, and what amounts to a link-up of the three undertakings of Eastbourne and its two northern neighbours. The terrain and consumer density seems unlikely to justify much more integration in this division.

So much for the technical achievements of the Board's distribution engineers; what of the administration of this diverse area? Mr. Medhurst shows that in the three divisions with the greatest gas output, the divisional distributing engineers are directly responsible to the Board's Chief Distribution Engineer, while in the other three they are responsible to the divisional general manager. This latter is, we feel, the more usual arrangement followed in the other area boards, but the fact that the completely integrated divisions represent something akin to an extension of the Board's Chief Distribution Engineer's department is significant of the large volumes of gas involved and distributed mainly from four production stations, reinforced by the Isle of Grain plant. The chief feeder main is the south London grid main, and we were interested to see from one of Mr. Medhurst's diagrams that the responsibility for this in whichever division it might run was that of the Metropolitan Division, though the extremely important Isle of Grain link was under the Kent Suburban Division.

Unfortunately, lack of space has prevented us from publishing the latter part of the paper dealing with the details of some of the more important holder stations in the Metropolitan Division, but we think we should at least refer to some of the points which appeared to us to be of more than passing interest.

Judging by the discussion that followed the presentation of the paper, it seems a commonplace that considerable modification is necessary to convert a former production station into an efficient holder and compressor station. The new buildings that were illustrated in the paper as being suitable for the new plant, were nothing if they were not unorthodox. The simplicity of the sheet-aluminium building and its ability to be dismantled when major repairs were necessary seemed functional in the extreme. It must be remembered, however, that had it not been proved that so much distribution plant would work equally well in the open air, such buildings would have been impossible.

We felt that this Board's efforts to combine efficient gas distribution and all the centralised control so necessary today with a realistic outlook on capital expenditure was most refreshing.

Conversion extraordinary

The North Western Gas Board has just finished what is claimed to be the biggest smokeless zone fireplace conversion task ever undertaken in this country by installing in more than 10,000 houses on Manchester Corporation's Wythenshawe Estate special grates, fitted with gas ignition, for burning any kind of solid smokeless fuel, or where there were suitable existing grates, fitting gas ignition points to them.

This completes the first stage in Manchester's plan to make the Wythenshawe Estate of more than 26,000 dwellings the largest smokeless zone in the country. The task took eight months to complete. The second stage will come into force next July, and the Board has received an enquiry for undertaking similar work in a further 5,425 dwellings in the second zone.

In order to get the work done within the time set the Board had to plan each step like a battle operation. Commandos of fitters drawn from all parts of the Board's Manchester area were moved daily to the Wythenshawe Estate in a specially purchased double-decker bus whose lower deck was converted into a work office and stores. On ordinary workdays 20 fitters tackled the installations, working to a close time schedule.

At weekends this fitter force was stepped up often to

70 men. Appliances, of a type and finish approved by the Corporation, together with materials and tools needed were carried with them to strategic points on the estate to minimise travel times and eliminate waste effort.

Clearly the installations will produce a useful gas load as well as a market for coke. But apart from this, the Board's ability to cope with a job of this nature swiftly and efficiently must enhance its reputation to no small degree.

Divergence by carbonisation

IS our sister industry, the coking industry, as close to us as she has been in the past? This is a question which we may well ask ourselves when we realise the tendencies in production processes now apparent in our own industry. Answers to such questions as these become clearer when we attend the annual meetings of the Coke Oven Managers' Association held in London. Something in between a social reunion and an exchange of technical information, these meetings—especially since the joint technical meetings of the Association and the Institution are now permanently established on a sound basis—form a bridge between two extremes in outlook, brought about by differing stress on the value of the two main end products of carbonisation, and in many cases by the scale of the production plants.

The 1961 meeting held recently was no exception, though it might be said to be exceptional. The joint meeting at which we heard a paper on benzole refining by Mr. J. B. Lane, Technical Managing Director of Lancashire Tar Distillers Ltd., was quite outstanding, both for the quality of the subject matter and for the personality of the author, who clearly had a most stimulating effect on his audience. But how much does this particular subject really interest the gas industry? Outside the two metropolitan gas boards it is, we fear, likely to be only marginal, though a number of gas engineers took part in the discussion.

The character of the coking industry tends to be more circumscribed than the gas industry and we should imagine that with the reduction in the number of plants in the last decade, and the fall in the quantities of coke needed to smelt a ton of iron ore—both these points were brought out in Mr. G. E. Hall's Presidential Address and Sir Frederick Scopes' speech at the annual dinner—the future of the industry might be in some doubt. But the output of steel is rising and with fuel economy at the blast furnace coke is likely to continue as the chief fuel in preference to other methods of iron smelting now being tried.

Though no major 'break-through' in coke oven technology has emerged in the last 40 years, there has been a tremendous development in traditional methods. Oven size has increased to more than double, plant units of 1,000 tons a day or over are a commonplace, amenities have improved greatly, and centralised control and automation have begun to be accepted.

In the steel works plants especially these advances will no doubt be fully exploited, but it was at the 'merchant' plants where centralised control was first tried out on an appreciable scale and proved its efficiency in reducing labour demands. Like the gas industry the coking industry is taking great pains to develop a good standard domestic coke, especially suitable for the closed domestic boiler, and here we feel it may well have the edge on the gas industry.

Increasing quantities of surplus gas from its sister industry are really what concerns our industry most, and long may it continue to obtain this to the satisfaction of all concerned.

BRIEFLY . . .

Salaries under fire

There are some curious anomalies in the salary structure of the gas industry, and policies clearly vary from one area to another. Boards must balance their desire to fill posts in an economical manner with a long-term regard for attracting the right kind of man to the industry; meanwhile the situation is distorted by the dwindling number of gasworks. We think many readers will be interested in the letter from Mr. J. R. W. Alexander and Mr. G. W. Phillips published in our correspondence column this week.

Skeleton in our cupboard

With a commendable, if somewhat macabre, thirst for the truth the West Midlands Gas Board magazine has done a little research on the identity of the gas industry's biggest villain. Nobody is likely to dispute their choice—Dr. William Palmer, the multi-murderer who rejoiced in the title 'Prince of Poisoners.' We were familiar with Palmer's notorious criminal career, which came to an end on the scaffold before an audience of 30,000 people, but we had not previously known of his connection with gas. Apparently he was a director of the Rugeley Gas Company.

Wanted—a magazine title

Mention of the West Midlands Gas Board magazine reminds us that it is seeking a snappier name. The current issue announces a competition to dream up a title as neat as the Southern Gas Board's *Flame* or the North Western Gas Board's *Link-up*. It will be interesting to see what brainwaves come to light, for the invention of a suitable name is a tougher job than it might appear. Something like the *West Midlander* is a little long-winded, while most words like *Contact* have already been appropriated by someone else.

Cakes and ale

Miss Megan Womersley and Miss Maureen Baron, the two East Midlands Gas Board home service advisers who hit on the idea of laying on beer for the 30 businessmen who attended a lecture on kitchencraft, must have been gratified by the publicity which resulted. Thanks to certain of the national Dailies the Board's decision to adopt the free beer idea for all their stag dems. should bring an unprecedented queue of gentlemen agog to learn the intricacies of constructing a shepherd's pie. For once no killjoy can start moaning about the public's money being frittered away on riotous living, since it would seem that the brewers are not unaware of the publicity potential in supplying a few dozen bottles to such a worthy cause.

PETER W. SHERWOOD *takes a look at—*

TRANSPORTATION

***LIQUEFACTION** provides a potentially economic means for transporting natural gas under conditions where use of long-distance pipelines is neither technically nor economically feasible.*

Now in an advanced experimental stage, this method of gas transport offers a means of gas disposal to surplus areas, a source of natural gas for gas distribution systems and for petrochemical and other industrial operations.

Although most of the technical hurdles have been overcome, large-scale movement of liquefied natural gas will be accompanied by major shifts in several industries, will certainly be accompanied by policy and legal problems of first-class magnitude.

Because of the impact which this development may eventually have, it behoves the oil and gas industries to view liquefaction of natural gas carefully at this early stage.

The present article calls attention to major aspects of this impending development :

SCOPE

HISTORY

TECHNICAL PROBLEMS

ECONOMIC OUTLOOK

POLICY CONSIDERATIONS

DESPITE the rapid expansion of pipelines for long distance gas transmission in the United States and Canada, there remain a great many gasfields, both in these countries and in other producer nations, where transportation facilities are still inadequate. The problem is most pronounced in Venezuela, North Africa, the Middle East and Pakistan in which natural gas supplies far exceed ability to consume.

For these gasfields, the industrial nations in Western Europe, Australia and Japan offer an attractive market. Here, however, gas transmission lines are out of the question (except possibly from North Africa to Europe) and bulk shipment of gas under pressure is also economically unsound.

It has been established that the lowest-cost means of transporting large quantities of hydrocarbon gas in ships is in the liquefied state and at essentially atmospheric pressure, near the hydrocarbon's boiling point.

Efficient use of shipping

At this condition, the fuel occupies the least volume (1 cu.ft. of liquid methane is equivalent to 630 cu.ft. of gaseous methane), and shipping space is therefore more efficiently utilised. This, therefore, appears to be the only economic solution to the problem of long-distance movement of natural gas over distances where pipelines are not feasible.

Obviously, the ideal sources of natural gas are areas in which there is no significant local demand for fuel and which are not served by collecting pipelines, but which do have access to navigable waterways. In such areas, much of the gas is either not produced at all or, if co-produced with oil products, it is flared. Its recovery and shipping to the energy-hungry industrial centres is a principal objective of liquefied gas transportation.

Long-range impact

The long-range economic impact of transporting liquefied methane can be gauged from an estimate of the Economic Commission for Europe, which indicates that over 1 bill. (10^{12}) cu.ft. of natural gas are flared annually in Venezuela and the Middle East. New York's International Energy Reports estimate total world reserves of natural gas as high as 1,870 bill. cu.ft. Most of these supplies are inaccessible to the industrial and populous areas of the world where the big demand for energy is centred.

According to data of W. R. Connole, of the U.S. Federal Power Commission, it takes only four medium-sized tankers with a useful carrying capacity of 15,000 tons to supply Western Hemisphere natural gas to European population centres with a demand of 100 mill. cu.ft. per day.

While long-range, the principal importance of shipping liquefied natural gas is to areas which now have no access to this fuel, the short-range impact may be more severe in

OF LIQUEFIED NATURAL GAS

areas which are currently served by natural gas transmission lines.

The reason for this is that these latter areas are already equipped in their domestic and industrial burner installations to handle methane so that costly conversion is not necessary.

On the other hand, methane-deficient areas are now served by manufactured gas and other fuels and it will take time and money to adapt their facilities to the point where they are capable of depending on a methane distribution system served by liquefied natural gas.

Two different types of use for liquefied natural gas must therefore be distinguished:

1. As a continuous source of supply for gas distribution systems and for large-scale industrial users of methane. For example, this method of transportation offers an opportunity for petrochemical plants to be located in areas which are not adjacent to large refinery complexes and which have no access to methane transmission lines.

2. As supplemental fuel source for large-scale fuel users. Here, the principal potential application is seen in 'peak shaving.'

Peak shaving is an essential operation in gas utility systems which obtain their raw material by transmission line (as distinct from manufactured gas). Such peaks above average load are the most expensive increment to supply and they occur during only a very small percentage of the total year.

Young[6] cites a study of seven utilities which showed that peak 40% of fuel demand was utilised less than 60 days out of the year.

Since transmitted gas is charged on the basis of (*a*) a demand charge, and (*b*) a commodity rate, the demand charge imposes a heavy burden on those quantities of gas which are not taken during a large portion of the year.

At present, for example, the average yearly demand charge for eastern gas is $22 per 1,000 cu.ft. This is calculated to provide a fixed charge corresponding to 12% of pipeline investment.

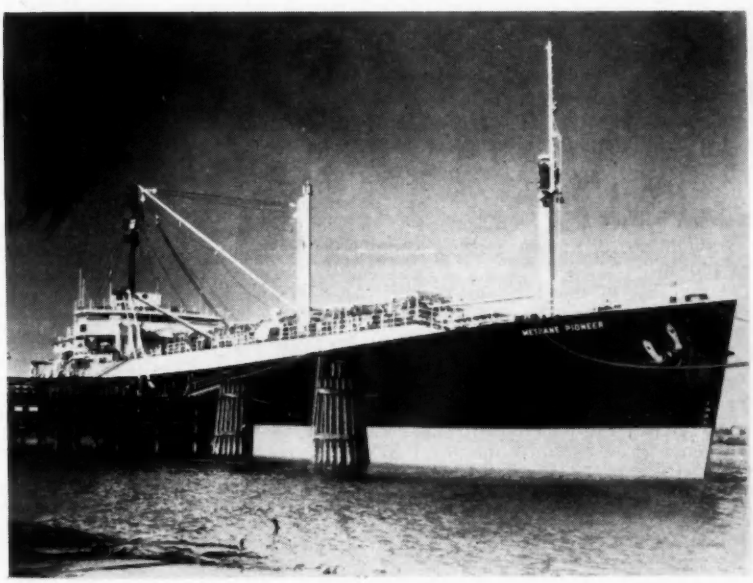
With the increase in pipeline costs, it may be expected that the demand charge will rise quickly and may reach $75 per 1,000 cu.ft. per day if transmission facilities are to be expanded to the point of supplying the entire peak demand, without supplemental sources of fuel.

Meeting peak needs

To some extent, the peak requirements can be met by transferring gas from customers who are purchasing under interruptible gas contracts. Such gas is sold at particularly low rates because interruptible contracts provide a flywheel for the distribution system. However, the amount of gas which can be sold under interruptible contracts is quite limited in most localities.

Several other approaches are therefore taken to supplying a portion of this peak gas demand, and this approach is referred to as 'peak shaving.' One such method is to supplement natural gas by air-reformed propane or oil.

Air-diluted propane is used by almost all major utilities



The Methane Pioneer, soon to be used for trans-Atlantic shipment of liquid butadiene, has proved the economics of transporting liquefied natural gas.

for peak shaving but this fuel source is not only fairly costly but it is also associated with the problems of interchangeability and gravity limits. Some authorities, moreover, feel that the price of propane will increase more rapidly than that of methane because markets are opening up for the heavier hydrocarbon at a faster rate.

It is therefore expected that liquefied natural gas will be drawn on in this service in increasing measure since it is a lower cost fuel and the main investment cost is in the storage facilities.

Most of the natural gas to be stored will be received via transmission line during the summer months and will be liquefied at the receiving end. Only after this source is exhausted, or the capacity of the transmission lines is exceeded, can ship transport of liquid methane be considered to be a likely source of peak shaving fuel.

There are only a few liquefied natural gas storage facilities. During the early 1940s a plant for the liquefaction of 4,000 mill. cu.ft. per day of natural gas was operated by East Ohio Gas Company in Cleveland. Ultimate storage was 250,000 mill. cu.ft.

Major explosion

The plant operated satisfactorily until late 1944 when it was destroyed by a major explosion caused by tank rupture. A subsequent investigation has shown that this disaster was caused by the use of unsatisfactory metal as construction material, and this problem has now been overcome.

A somewhat similar plant designed for the liquefaction of 4,500 mill. cu.ft. per day was built in the United States and given to the U.S.S.R. in 1947 under Lend-Lease. This unit is reported to be operating satisfactorily to this day in the Moscow area.

Currently being watched with great interest is the experimental operation of the Methane Pioneer, the converted 5,000-ton cargo ship which carries 2,000 tons of liquefied methane per trip from Constock International Methane terminal at Lake Charles, Louisiana, to a receiving terminal operated by the Gas Council, on Canvey Island.

The liquefaction plant operated by Constock International has a capacity of 6-8 mill. cu.ft. per day. The British receiving terminal consists of two tanks, each of which is capable of holding 1,000 tons liquefied natural gas. Several ship designs for carrying liquefied methane near its boiling point at atmospheric pressure have been investigated.

Double hull construction

Szeszich[1] concludes that the most practical approach is the use of a ship of double hull construction, allowing for a very large hold without partitions or insulated tanks. This concept has also been applied to the conversion of T-2 oil tankers, for simultaneously carrying liquefied natural gas and oil.

In the case of the Methane Pioneer, four rectangular aluminium tanks are installed into the holds of the ship. Although the tanks are carefully insulated, some boil-off of methane will inevitably occur.

Means must be provided for disposing of the boil-off gas. This can be used as an alternate fuel or may be simply vented off after being diluted with enough air to avoid occurrence of an explosive mixture. By far the preferred approach is to reliquefy the boil-off gas.

This means that a relatively small liquefaction unit must be continuously operated on the ship. For safety reasons, stand-by facilities are provided to effect the safe venting of boil-off methane in case of failure of the liquefaction unit.

A liquid methane transportation system consists of the three key components: Liquefaction plant, storage (at point of origin, aboard ship, and at receiving point) and revaporisation plant.

Liquefaction.—The atmospheric boiling point of methane is −259°F. Several refrigeration cycles are available to achieve these low temperatures. Indications are that two cycles are the most attractive for liquefaction of natural gas—cascade operation for large plants, and methane expansion cycle for small units.

The cascade system involves cooling the feed gas by a series of coolants at successively lower temperature. For example, a plant operated in Cleveland during the early 1940's, liquefied natural gas in a cascade system consisting of water, ammonia, ethylene and methane.

Thermally, the most efficient cycle among readily available refrigerants involves the use of water, propane, ethylene and methane. For operation in the gasfields it may be more practical to substitute ethane for ethylene because of the former's ready availability at the site.

In that case, propane may be operated between 25 and −45°F., ethane in two pressure stages at which the evaporation temperature is −80 and −120°F. respectively, and finally two or three methane refrigeration stages in which the evaporation temperature gets down to −259°F.

By contrast, a methane expansion cycle uses only methane as refrigerant for the natural gas. Its high-pressure stage may be operated at 1,500 p.s.i. where the refrigerant is liquefied by a propane refrigeration cycle. Liquid methane is expanded through an expansion engine and exhausts at −250°F., and at that temperature cools the natural gas feedstock, which is at elevated pressure, say also at 1,500 p.s.i.

Off-gas recycled

The liquefied natural gas is allowed to flash to atmospheric pressure. Off-gas obtained at this stage is recycled to the liquefaction process.

Of the two cycles, the cascade process is thermally more efficient. DeLury[3] reports that a well-designed expander plant requires 830 b.h.p. compared with 460 b.h.p. consumed by the cascade cycle.

This consideration is important not only from the point of view of power consumption but also because the investment cost of the liquefaction plant is related directly to the horsepower requirements.

Therefore, for large installations, the cascade system is the only economically suitable refrigeration cycle.

However, cascade plants are relatively complex and take up a large amount of space. Therefore, for small units and where space requirements are critical as is the case aboard ship, for example, the extra cost of the expander cycle may well be justified.

More work remains to be done to determine just how pure the feed gas to the liquefaction unit must be. Carbon dioxide and water must be removed, but it is indicated that the extent of carbon dioxide removal which can be achieved by amine scrubbing is adequate.

Aromatics seem to be insoluble in liquid methane. This may be a problem especially in liquefying Middle Eastern gases which are rich in aromatic components. In their case, it is probably necessary to withdraw condensed cyclic compounds at some intermediate stage of the liquefaction cycle.

In the course of liquefaction, nitrogen remains gaseous and is thus separated from the methane. While this is desirable from a transportation point of view, complete

removal of methane from the nitrogen stream is not practical.

Instead, a small portion of the fuel is allowed to remain in the gas stream. The preferred approach is to retain a nitrogen off-stream containing enough hydrocarbon to permit its use as fuel for operating the liquefaction unit.

Storage.—At present, all liquid natural gas storage is in above-ground tanks. The lead storage tanks constructed in connection with the Methane Pioneer movement are flat-bottomed, double wall, cylindrical units with umbrella roof construction. The inner tank is aluminium. This is surrounded by a three-foot layer of granular perlite insulation. The outer shell is carbon steel.

These tanks are set on concrete piles so that a 2-ft. ventilating space is provided under each tank. Furthermore, the tank's foundation is equipped with heating coils in order to prevent the soil from freezing. DeLury reports that daily losses from these tanks are about .2% of the volume when full. The tanks are surrounded by dikes. Recommended dike volume is 110% of storage tank capacity.

Dry nitrogen

The insulation space between the shells of the tank in the Methane Pioneer is supplied with dry nitrogen at slightly positive pressure. Its purpose is to prevent the in-breathing of air which would lead to the accumulation of moisture in the insulation.

The gas composition in the insulated space is continuously monitored and an alarm is sounded if any hydrocarbon gas is detected in it.

Tests carried out in conjunction with the Methane Pioneer shipment indicate that handling liquid methane is potentially less dangerous than shipping petrol because the methane is constantly boiling. As a result, there is a positive pressure inside the tank which prevents entry of air into it, thus avoiding danger of forming an explosive mixture.

Metallurgical problem—Because of the very low temperatures involved, the metallurgy of storage tanks constitutes an important problem. Below 0°F, the impact strength of plain carbon steel decreases rapidly. Improvement in this property can be brought about by increasing the nickel content of the steel. Stainless steel and aluminium alloys remain ductile even at −423°F. For these reasons, present storage tanks for liquid natural gas employ aluminium for the inside shell.

Deep-well pump

For unloading purposes, the Methane Pioneer is equipped with a centrifugal bronze and stainless steel deep-well pump of a capacity sufficient to unload the tanker in approximately ten hours.

Various other metals and designs of storage tanks are currently being investigated and tested, among them the use of nickel-steel inner tanks, aluminium and nickel inner tanks, buried in pre-stressed concrete, outer tanks of aluminium and steel installed in rock caverns and uncontained liquid methane stored in rock caverns.

Underground storage—Because storage facilities are the most expensive portion of the liquid methane installation at the consuming centre, methods have been sought to provide storage at lower unit cost. The obvious approach is storage in underground facilities. This has been investigated recently by Flanagan, *et al.* of the Texas Petroleum Research Committee.

For the cost of mining caverns suitable for storing liquid natural gas, they estimate $0.75-1.25 per thousand cu.ft. of storage. By comparison, Young[5] estimates the installed cost of above-ground liquid methane tanks at $7 per thousand cu.ft.

Underground storage may also be safer and is believed to require less maintenance than would be the case in above-ground storage.

When the liquid methane is charged into the underground cavity, it will first have to cool down the surrounding rock. This heat exchange is accompanied by evaporation of some of the liquid methane charged. Calculations show that the vaporisation rate drops rapidly, and that at the end of one month it would be 50,000 cu.ft. per hour for a cavern of 25 ft. radius. At the end of ten years, the evaporation rate would only be 18,000 cu.ft. per hour.

Contamination of methane in the underground storage would probably be very small. The reason is that any likely contaminant namely, CO_2, H_2S and ammonia would be solidified as it migrates toward the cold storage area, and would thus be stopped from entering into the cavity.

While Flanagan's calculations were limited to mined underground storage facilities, it is probable that salt domes will be the preferred geological formation when available. The techniques which have been developed for underground storage of l.p.g. can be adapted in large measure to the storing of liquefied methane.

Revaporisation—As methane is withdrawn from storage at the consuming centre, it must be vaporised. Several schemes have been developed for utilising the refrigeration effect of the vaporising methane. Actually, these proposals are not too practical because there is relatively little demand for the low temperature refrigeration involved.

Alternative approach is use of the expanding methane to generate power. At 200 p.s.i.a. about 670 h.p. hours per 100 lb. moles methane can be recovered in this fashion.

Marginal significance

This auxiliary step provides some savings in the operation but is only of marginal significance on the overall economics of methane liquefaction.

In most proposed systems, a relatively simple heat transfer system serves for the vaporisation of methane at the consuming end. To eliminate condensate freezing problems one design uses propane as heat transfer medium from 50 p.s.i.g. steam in a closed thermal syphon system.

The installation at Canvey Island employs a steam-heated evaporator, but it is planned to use river water eventually for vaporisation purposes.

Key to the economics of long-distance shipping of liquefied natural gas is, of course, the price of competitive fuels in the area to be supplied. Thus, in the north-eastern United States, natural gas is currently piped in at approximately 80 cents per thousand cu.ft., and in Europe coal gas of an equivalent heat content runs from $1.00 up. In both areas there is strong upward pressure on prices.

In general, it is suggested that operation for the liquefaction of natural gas should not be smaller than 1,000 tons per day for economic performance. Estimated investment costs vary widely. Szeszich[1] provides the following estimate:

Gas liquefaction plant—$300 to $400 per thousand cu.ft. per day; above-ground storage—$1.70 to $5.50 per thousand cu.ft.; methane-carrying ship—$700 to $850 per ton of carrying capacity; revaporization plant—$7.60 to $10 per thousand cu.ft., of gas per day.

A breakdown of liquefaction plant costs by Lederman and Williams[2] shows that depreciation is by far the overriding cost item amounting to 40-50% of the total liquefaction cost. Another 25% or so is chargeable to other fixed and fairly stable costs. The overall yearly cost of

plant operation is therefore quite insensitive to the throughput.

This means that the plant can be operated economically only with a high load factor. A similar analysis applies to the cost of ship operation which also requires near-capacity use for adequate payout.

With 100% load factor, Lederman estimates that methane can be liquefied at the Gulf Coast or in Venezuela and delivered to the East Coast of the United States for 25-46 cents per thousand cu.ft. Of this total, 13 cents are accounted for by processing cost.

Shipment from the same source to England results in a cost of 30 to 51 cents per thousand cu.ft. In both cases the investment for a demand of 400 mill. cu.ft. is estimated at 220 to 240 mill. dollars.

Payout on the facility depends sharply on the price of competitive fuel gas in the receiving area. At a raw materials price of four cents and a competitive price of 80 cents per thousand cu.ft., payout is calculated at three years. If the raw material should cost 20 cents per thousand cu.ft., the payout time rises to 3.6 years.

The payout on the liquefaction facilities can be aided by separating higher-valued l.p.g. if these are present in substantial concentration in the raw material. The quality of the gas itself can be upgraded by separation from nitrogen which is possible in the liquefaction step.

A study by L. J. Clark, of the North Thames Gas Board, indicates that over distances greater than 1,000 miles, it is cheaper to transport natural gas by ship than to transmit it through pipelines.

Tentative data

According to Clark, marine shipment of liquefied methane over a distance of 4,000 miles can be accomplished at the same cost as pipeline transmission over 1,800 miles. It should be pointed out, however, that these data are tentative and remain to be demonstrated in practice.

If the large-scale distribution of liquefied natural gas ever becomes a reality, it will raise a great many political, legal and economic problems. Connole[5] points out that the political problems will be somewhat the same as those which confront the oil industry in its problem of import regulations, but that they will be much more complicated because the natural gas industry is regulated and thus has a large number of additional problems.

Furthermore, imported liquefied natural gas will compete with locally produced fuel sources in a number of countries, notably in the United States and Canada, and questions of tariff as well as of national policy are involved.

Where liquid methane serves for peak load shaving, advantage may be taken of the fact that peak loads in the northern hemisphere occur at directly opposite times of the year as in the southern hemisphere. Therefore, there is a good possibility of peaking in northern and southern hemisphere cities with the same tanker equipment at different times of the year.

To the extent that such an arrangement can be made, a 100% load factor can be achieved and this will have marked effect on keeping the cost of shipping liquefied natural gas within limits set by the price of competitive fuels.

Threat to competing fuels

Nevertheless, the importation of liquefied methane would threaten competing fuels such as coal and oil to a certain extent, and thus raises further questions of what in this area may be in the public interest.

The Vice-Chairman of the U.S. Federal Power Commission has pointed out that the import of liquefied natural gas raises such questions of national and international policy as the need to preserve domestic economy, the natural preference for domestic producers over extra-territorial producers of natural gas, the need to avoid too much dependence on sources of energy which are beyond the importing country's control and which can be reached only through dangerously long and highly vulnerable supply lines.

These are major policy questions which will face the fuel-producing industries and the various governments involved. With most of the technical problems in the movement of liquefied natural gas resolved, an answer to the political and legal questions may be called for in the near future.

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AIR POLLUTION DETERMINATION

WHEN B.S.1747 was first published in 1951 it was concerned solely with deposit gauges. Now it is being re-issued in several parts to cover, in addition, apparatus and procedure for the measurement of (1) fine particles (smoke), and (2) gaseous impurities, as well as the solid material (such as grit) which is measured by the deposit gauges specified in Part 1 of the standard. [*Revised British Standard Methods for Determination of air pollution (B.S. 1747 : 1961)—Part 1. Specifications for deposit gauges*].

Experience in the use of deposit gauges during the past ten years has enabled the British Standards Institution committee concerned to introduce a number of refinements into the standard but the procedure outlined is substantially unchanged.

The standard deals with the construction, installation and use of deposit gauges. A standard report form and a statement of the analytical determinations to be made are included.

Copies of the standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 5s. each (Postage will be charged extra to non-subscribers).

From a paper to the Institution of Gas Engineers, London and Southern Section, London, October 17.

The organisation and operation of a distribution department

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IN 1956 the South Eastern Gas Board's area was divided into seven separate areas, referred to as 'divisions.' The manufacture and distribution of gas in each division was the responsibility of a divisional engineer, who had a distributing engineer at divisional headquarters dealing with main and service work. The transfer of gas within the division, and the operation of holder stations, was the direct responsibility of the divisional engineer. The divisional engineers in the Metropolitan, Kent Suburban, East Surrey and West Surrey Divisions were responsible directly to the chief engineer at area headquarters, and the remaining three divisional engineers in the Rochester, Dover and Sussex Divisions were responsible to the chief engineer through two general managers. The distributing engineer at area headquarters was responsible to the chief engineer for advising on all distribution questions, but had no direct control over the operation of each divisional distributing engineer.

In 1956 gas was being manufactured at 44 works, and there were 84 holder stations. Since then integration within the Board's area has continued, and there are now 14 manufacturing stations and 105 holder stations. In 1957 the control of holder stations and the transfer of gas within the Metropolitan, Kent Suburban, West Surrey and East Surrey Divisions, and later the Rochester Division (now renamed Medway Division) was made the responsibility of the area distribution engineer, and the five divisional distributing engineers were placed directly under his control. The two distributing engineers in Dover and Sussex also assumed these responsibilities under their respective divisional engineers. In order to achieve uniformity of operation and methods, the chief distribution engineer advises on matters of distribution in these two divisions also.

Sound divisional organisation

The increased responsibilities of the divisional distributing engineers make it very necessary for their divisional organisation to be sound, and planned for the duties which have to be undertaken. Considerable thought has been given to this matter in order to develop an organisation which will carry out these duties efficiently, and allow the distributing engineer to fulfil his proper function of controlling his division without being burdened with a host of day-to-day matters which can, unless care is taken, become the predominant part of the day's work.

When considering a new organisation, or the re-organisation of an existing department, every effort must be made to ensure that the plan is such that further changes will not have to take place for at least a considerable period of time. There is now a need, perhaps, for specialised engineers in distribution departments, though that is not to say that each engineer should not have a sympathetic and general knowledge of his colleagues' work—that is most important—but he must be right on top in his particular sphere of operation.

Each of these engineers must be well in the picture regarding the general operation and policy of the department, and there should be an administrative assistant who would see that this is achieved.

In order that a common policy may be operated throughout the Board's area, meetings are held under the chairmanship of the chief distribution engineer, where the divisional distributing engineers meet the senior officers of the department. Items of common interest are discussed and, where necessary, general policy is agreed. These meetings are sometimes held in one of the divisions, thus making it possible for the members to see new plant in operation and to keep in touch with work being carried out by their colleagues.

Three functional lines

With these ideals in mind, and considering the added responsibilities of the distributing engineer, it was decided to divide the department into three main functional lines, each controlled by specialised officers: (a) An administrative assistant, (b) a mains and services engineer, and (c) a supply engineer.

All assistants will agree that theirs is a thankless job. They will say that they must have a working knowledge of all matters of distribution technique, and be able to speak on all aspects concerning the working of the department. They are nearly correct, but in a highly technical department such as the distributing engineer's department has now become, they must not attempt to become specialists in all fields but they must have the ability to know what to ask for and to use the knowledge of the specialist assistants. An assistant must work closely with his chief so that he can deputise for him in his absence, and be able to make decisions during the normal course of his duties. He is in direct contact with the distribution staff and must, therefore, be able to understand and control labour. He must be in close contact with his opposite numbers in the adjoining boards, in the other public utility undertakings, and in the various local authorities which are situated in his division. It is also most important that he should meet his fellow assistant divisional distributing engineers in his own Board so that ideas can be exchanged and discussed.

The administrative assistant has the difficult task of seeing that his engineer is free to control his department, and free to look and plan ahead. He must, obviously, be in

the confidence of the distributing engineer and must work closely with all the other officers in order to see that their activities are co-ordinated and that they are kept informed on all matters affecting their work. Each administrative assistant has a small staff of clerks at divisional headquarters, who deal with expenditure control, statistics, correspondence and general paper work concerned with distribution matters.

The various supervisors' clerks, while working under the instruction of their supervisor, carry out their duties in accordance with the methods laid down by the administrative assistant.

The mains and services engineer is a qualified gas engineer and is acquainted with civil engineering practices connected with earth works, timbering, heavy lifting, and such like. He has the responsibility of laying, and the maintenance of, mains and services by direct or contract labour and must, therefore, be capable of controlling men and of being able to hold his own when dealing with contractors and engineers of other authorities.

Immediate decisions

Work in the public highway, particularly in the London area, presents many problems which require immediate decisions, and the mains and services engineer must have sufficient experience to deal with these matters. He must also have a good working knowledge of the various statutory legislation covering work in streets. Close contact must be kept with similar engineers of other undertakings, and if this is done considerable savings will be made by careful planning in conjunction with them, such as common trenches and the joint use of compressors and cranes.

He has on his staff distribution supervisors who are responsible for a particular section of the division. These men are in direct contact with all main and service laying work in their district and must see that it is carried out economically and in accordance with standard practice.

The supervisor is kept acquainted with new methods, and is informed as to the costs of main and service work carried out in his district. He has a number of distribution foremen under his control and they also must be kept up-to-date so that their interest is maintained and they are made to feel part of the organisation.

The supervisor's office may be looked upon as an operational centre from which day-to-day administration and control of main and service laying is carried on. His clerk should have a good knowledge of the district and of the work associated with main and service laying methods and operation, and since careful planning is necessary if an efficient and economic organisation is to be operated, he must be able to make a substantial contribution to this end, particularly in the absence of the supervisor.

The clerk and foreman must work closely together so that a gang always has another job to go to when one is finished, and that the jobs are so selected that movement is kept to a minimum.

The supervisor's office is equipped with a radio transmitter/receiver, and contact can be kept with the supervisor and foreman as well as with the various vehicles which are fitted with similar equipment. Both the foreman and the distribution supervisor must do some clerical work but since their job is to supervise work and to see that it is carried out in a safe and economical manner it must be kept to a minimum. The foreman must check his men's job cards and the contractors' day sheets, but beyond that he must be free to do his own proper job.

The supply engineer, who is a qualified gas engineer, is responsible for all matters relating to the storage, transmission, and distribution of gas in his division.

For operational purposes the division is divided into two or more districts, each containing a number of manned and/or unmanned holder stations. Each district is the responsibility of a gasholder stations foreman, who is a craftsman and has a good knowledge of diesel and electric plant operation.

The operating personnel of a manned holder station are called holder station attendants, and are graded as No. 1, No. 2 and No. 3 attendants in descending order of seniority. The less important manned stations might be operated by one man only, and each case is judged on its merit.

The supply engineer, through his foremen, has direct control of manned and unmanned holder stations, and carries out all the necessary maintenance there, using either a small maintenance gang which is attached to each district—which includes an electrician and an engine fitter—or the services of the maintenance staff at major manufacturing works, or by employing contractors. He also controls the repair and maintenance of district governors, station governors, district valves and district recorders.

Instrumentation systems are maintained by the Board's instrument department who carry out a periodic maintenance programme in conjunction with the supply engineer. Normal routine maintenance of instruments is done by the gasholder station attendant, or by the holder station maintenance personnel. An important part of the supply engineer's duty is to ensure the economic operation of the pumping plant under his control, and he must have close contact with the gas control officer at sub-area control, to whom he will give information and instruction regarding availability of plant, method of operation of transmission lines, pressure requirements and similar matters.

Although the Board's area is divided into divisions for administrative purposes, the distribution network of each division is not necessarily kept isolated. One important duty of a supply engineer is to keep a constant check on the flow and pressure conditions in his division.

Varied selection of work

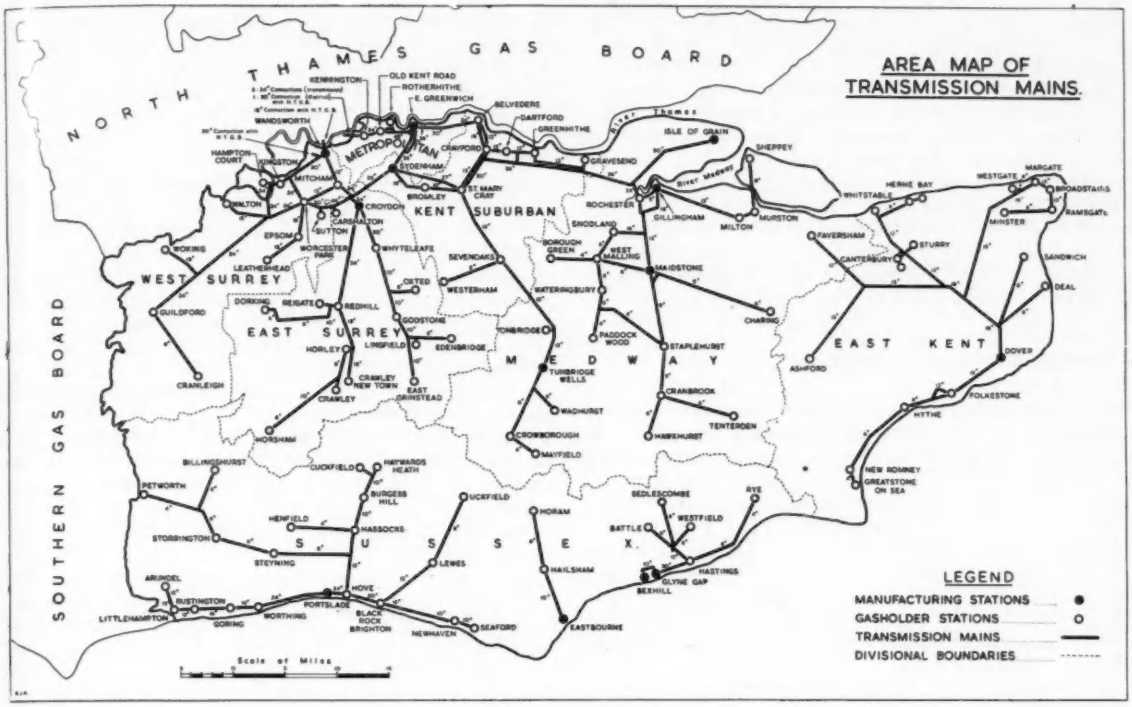
The personnel of a distributing engineer's drawing office have to deal with a very varied selection of work. Although this work falls into the two main categories of engineering drawing and cartographic drawing the draughtsmen should be reasonably interchangeable at the level of work carried out in their offices.

Each divisional drawing office is staffed by a draughtsman, who is the senior man, and three assistant draughtsmen. In addition there are one or two trainee draughtsmen who are given the opportunity of seeing the work being carried out on the district.

The divisional drawing office deals with all drawing work required in the division except that certain major projects are dealt with by the distribution section of the central construction department at area headquarters.

Major transmission mains are handled completely by the chief distribution engineer's department and the actual work in the field, including wayleaves, is the responsibility of the field engineer who, with a small staff, is based at a convenient site situated along the run of main.

The field engineer uses the services of an outside land agent in connection with the necessary wayleaves and negotiations with land owners. When the line of main and terms are agreed with each land owner the file is



passed to the solicitor for completion. The divisional distributing engineer is kept fully informed regarding the progress of work and, if necessary, the services of his drawing office are used in preparing layouts of the various connections required at either end of the transmission main. The field engineer's draughtsman prepares detailed drawings of the pipeline as it is laid, and this record is handed to the divisional distributing engineer on completion of the work.

Of the seven divisions only the Dover and Sussex Divisions are independent of any outside source of gas manufacture. The five remaining London Divisions have eight manufacturing stations connected to the transmission system, but the Isle of Grain works is the only station which does not supply gas direct to a low pressure distribution system. Over 70% of the gas output in the London Divisions is pumped through transmission mains, and the balance between the amount of gas made at each works and the gas compressed must be carefully controlled in order to achieve an economical combination of gas made and gas pumped. An area control room is set up at the Board's headquarters at Croydon, and at each division there is a sub-area control room dealing with gas manufacture and transmission within its own division.

Overall programme

In order to meet the estimated gas demand for the day an overall programme of gas manufacture and bulk transmission based on the current weather forecast is prepared each morning in the area control room. The divisional programmes of gas to be made, gas to be received or transferred, and the total gas stock levels to be held are passed on to and agreed with each sub-area control.

The internal divisional transmission rates and the stocks to be held at individual holder stations are then programmed by the sub-area control in conjunction with the supply engineer. The plan for the day is now completed and the estimated stock throughout the day at each holder station is plotted on magnetic wall boards, with the actual stock progressively added.

Each London Division is connected through a main transmission line running from the Isle of Grain and East Greenwich to Worcester Park. This line, or branches connected to it, passes through five divisions and any work on a section of main in one division can affect other divisions. It is essential, therefore, that each divisional distributing engineer should know precisely his responsibility regarding the section of main within his division.

Responsibilities

The distributing engineer of the Metropolitan Division is responsible for the main leaving East Greenwich works in a westerly direction and passing through the Kent Suburban and East Surrey Divisions, terminating at Worcester Park and Mitcham in the West Surrey Division. He is also responsible for the eastern section, where it passes into the Kent Suburban Division at Belvedere. Similarly, the Kent Suburban distributing engineer is responsible for the Sydenham/Isle of Grain system, where it passes to the Medway Division near the Isle of Grain, and for the southern branch to Tonbridge and Tunbridge Wells in the Medway Division. The responsibilities referred to above are limited to being informed of and agreeing to the necessary arrangements which have to be made in connection with any work affecting the flow of gas and/or pressure in the main.

The actual work, valve operation and safety measures are carried out by the distributing engineer in whose area the main is situated, and the timing of the complete operation is agreed with the area control, who are kept informed of the progress of work by the sub-area control. It is important that this sequence of passing information is adhered to since it ensures that both control rooms receive the same current knowledge of the progress of the

work. Normal repair and maintenance, such as syphon pumping, which does not affect the flow of gas, is carried out by the distributing engineer in whose area the main is situated.

With the closing of many gasworks and the integration of existing transmission and feeder systems in the Board, gas has to be pumped considerable distances, and although it is possible in many cases to feed gas back into the system from the normal receiving stations, a failure of a main along its route could be very serious. A rider, laid over the affected section of main, is only a partial answer unless the cross sectional area of the rider is equal to that of the main, or alternatively, some means of restoring the pressure drop across the rider is provided.

Diesel-driven gas booster

To meet this, a diesel-driven gas booster mounted on a four-wheeled trailer suitable for towing and able to be moved very quickly on to a site, is connected into the line of the rider pipe. With a capacity of 250,000 cu.ft. per hour at 35 in. w.g. differential, its inlet and outlet connections are coupled to manifolds each fitted with six 6-in. diameter spigot outlet ports. Any of these ports can be blanked off when they are not required for use. A half-mile of 6-in. i.d. polythene pressure tubing in 16-ft. lengths fitted with aluminium spigots suitable for use with victaulic joints, can be connected to the booster manifold ports referred to above.

In order to connect the polythene pipes to the affected main, a special manifold with six 6-in. spigot outlets has been designed for use with pipes between 12 in. diameter and 36 in. diameter. Where underground obstructions make it impossible to connect this manifold to a main, flexible caps drilled and fitted with light steel flanged bends are used. The manifold could also be used with under-pressure bagging-off and ridering equipment.

The 6-in. diameter polythene tubes, which are similar to those used by the London Fire Brigade can, of course, be used as a normal rider. They are semi-flexible and can be laid and jointed very quickly. If the pressure drop over the length of the rider is excessive, then the booster could be inserted in series with the polythene tube. Two or more boosters could be worked in series when a relatively small volume of gas at a high pressure is required, or boosters could be worked in parallel where the reverse conditions are wanted.

The polythene tubes are stored and stacked in crates which can be placed on to a lorry in a few minutes. Each crate can carry approximately 640 ft. of tube, *i.e.*, 40 lengths. The total weight of crate and tubing is 22 cwt.

The closure of a gas-making works and its subsequent conversion into a holder station presents the distributing engineer with many problems.

Often the plant is old and inefficient and spread about on a site much too large for a gasholder station. The old plant and buildings are best demolished and replaced by modern automatic or semi-automatic plant, erected in such a position as to make the holder station a compact unit.

The complexity of operation of various holder stations will vary from site to site. Some stations can be completely unmanned while others require personnel to operate them. The number of personnel on duty at a station will depend upon its importance and on the type of operations to be carried out by the plant.

Three main points should be kept in mind when reconsidering a reconstruction programme for a holder station.

1. Savings in maintenance and operating costs.—Labour costs can form a large part of the running costs and very careful consideration must be given to the possibility of developing a fully unmanned automatic station. Remote indication and control should be employed if justified both economically and operationally, but care must be taken in deciding the amount of remote indication equipment to be installed, to avoid including functions which are not essential to the running of the station.

If the transmission main pressure at the inlet to the station is suitable, a jet booster may be used, with a mechanical booster installed as a standby should the inlet pressure fall. Some holder stations have an intermediate pressure system which feeds gas to the district through high pressure governors. This type of system, however, should be carefully examined since it might be an advantage economically to lay low pressure mains, or make a few connections on the district which would eliminate the need to pump gas from the station. Alternatively, if the pressure in the inlet main is suitable, it might be possible to pass this gas direct to the medium pressure system, in which case a booster would only be required if there was a temporary failure of the grid supply, or perhaps to take the peak hour load when the hourly rate of gas into the station was below that needed for the medium pressure system.

Maintenance costs must be considered when the new layout is being designed. It is no good designing a scheme without this in mind and then trying to reduce costs after the reorganisation. Where possible pumping plant and prime movers should be erected in the open. The conventional building is a costly structure, requiring painting and cleaning.

If protection is required for a diesel engine it can be afforded by a simple aluminium structure which can easily be dismantled when major maintenance work is to be carried out. Control apparatus and electrical equipment which require protection from the weather can easily be housed in aluminium clad structures. Governors and automatic valves can be installed in concrete pits fitted with insulated aluminium covers for protection against freezing.

Site area

The site area, which should be cleared of all trees, grass and redundant buildings, should be paved with tarmac or shingle, thus making weed control a simple matter. The completed site area, which should be securely fenced, could include a separately fenced area suitable for parking vehicles owned by the Board. Access between this parking area and the operating area of the holder station should be by a locked gate, the keys of which are held only by persons authorised by the distributing engineer.

2. Safety of personnel and plant.—The erection of plant in the open will almost completely eliminate the chance of an explosion due to leaking gas. Valves are fixed either above ground in the open or are below ground, but never in a pit where an explosive mixture can collect.

Governor pits should have a maximum depth of 4 ft. 6 in. so that a man standing on the floor of the pit will have his head and shoulders above ground in the fresh air. Where control rooms are constructed on a manned site, one outside wall is glazed to a low level so that an attendant can always be seen when inside the building. All holder syphon pumping must be carried out from ground level and not, as one sometimes finds, in a syphon pit 15 ft. or so below ground.

3. Security of operation.—Good maintenance must play an important part in the security of operation of a holder station. It must be planned and carried out by skilled men and carefully recorded so that the supply engineer can assess and plan for future work. Arrangements are made at every unmanned holder station for a safety governor to be connected between the inlet main and the outlet main

of each station governor. It is set to operate at a predetermined pressure below that at the outlet of the station governor. A standby diesel-driven booster placed in parallel with the working booster is so controlled that it will come into operation on the failure of the first booster.

Where a jet booster is installed, a standby mechanically-driven booster in parallel ensures continuity of gas supply should either a low inlet main pressure or a mechanical fault in the jet booster installation itself render it inoperative. The standby booster is fitted with a clock control to prevent it working during the night when the transmission main pressure might be low or when the operation of the jet booster is not required.

Gasholders on unmanned stations are fitted with the usual maximum and minimum cut off gear, operating either the volumetric governor or individual automatic diaphragm type holder valves. Where a holder station is the only supply to a district, and where at certain times of the day commitments on the transmission system make it impossible to give a full emergency supply through the safety governor, two station governors are installed in parallel. One governor is set to operate at a pressure slightly below the outlet pressure of the main working governor, so should the latter fail, the second governor will automatically take up the load and give a full supply to the district at a slightly lower pressure. It also allows work to be carried out on either governor without the need to operate a by-pass valve continually. The standby governor also covers clock control failure of the working governor or auxiliary governor trouble.

Non-return valves are used on the outlets and by-passes of boosters installed at manned and unmanned holder stations, and they permit the standby or working boosters to start delivering gas without manually operated valves having to be opened or closed an important point in manned stations where the operation of large diameter valves may require a considerable number of turns.

In addition to the foregoing mechanical safeguards each holder station is visited by the holder stations foreman concerned once a day. During this visit a general check is made on the stock position and on the working of the station.

GAS ON THE CONTINENT

Computers in planning pipe-laying

AMONG the increasing uses of computers in industry is the detailed work of planning transmission lines and buried pipelines. This article gives details of the use of an I.B.M. 650 computer having a magnetic drum memory unit, with card unit Type 533 and tabulating machine Type 407 for this purpose. The author gives proposals for field log-book ruling and for the use of the 80-column punched cards.

Besides the considerable time saving and the increased detail practicable with the resultant effect on tendering, the use of such methods offers much better accuracy compared with normal manual methods. The computer can calculate, for each point along the line of the pipe, the depth to which the trench is to be dug, the area of the profile, the total volume of material removed and hence its weight, the developed length of the pipe and the angle at any discontinuities.

Account can be taken of differing profiles of the trench to suit differing ground conditions without incurring appreciable extra work. In the event of difficult excavation conditions different routes and levels can be tried out quickly to find the most economic line. The tabulated results can be presented in a manner particularly suitable for field use, e.g., distance between marks, depth and width of trench at top and bottom.

In the event of meeting an obstacle the line can be replanned as required in a short time. The work of quantity surveying is greatly reduced. The next stage in development is to draw up the punched cards from an automatic co-ordinating machine using aerial photos, e.g., by the Koordimat, made by Zeiss-Aerotopograph.—*R. Gessmann* and *A. Pflüger, Das Gas-und Wasserfach, June,* 1961, **102;** 611.

Prestressed parts of a Berlin gasholder

IN the last two years a second 4-lift gasholder has been installed at the Berlin-Charlottenburg gasworks. In providing 200,000 cu.m. content, height restrictions, due to the proximity of an airport, have necessitated a large diameter (80.6 m.) with a height of fully expanded lifts of 41.9 m.

Analysis showed that a 10% saving could be made if the tank was made in prestressed precast reinforced concrete panels instead of steel. The height of the wall of the tank is 11.55 m. and it is formed in 16 panels. Trial borings had shown that water was to be found some 2.5 m. below average ground level. The foundations were placed 30 cm. above the water table, deeper excavation to 5.6 m. was required for inlet pipes, etc., which was done with seven 10-m. and one 14-m. well points.

Concrete for the foundation is provided with protection against ground water attack. The tank was designed to withstand filling with water and has a 2.2-m. wide flange at the top to withstand wind forces. A sliding layer of bitumen is provided on top of the annular foundation so that the post-stressing wires can be applied without transferring stresses to the foundations.

The wall panels have two layers of reinforcement and were cast in panels using a pair of moving segment forms. Each wall section required 70 cu.m. of concrete and was cast in 14 hours with a monorail and a rail-mounted tower crane, and vibrators. An electric winch was used to move the forms.

The joint between segments is made with a Ductube and later grouted. The post-stress consists of 2,000 turns of 5 mm. diameter 150/170-kg. per sq.mm. wire, which is tensioned to 1.9 tonnes and layed at 6-mm. pitch.

Over the bottom third there is one layer of wire, over

the middle third two layers and the top third three layers of wire; 2-cm. thick dry concrete is sprayed between layers.

Clamps are placed at eight points on the circumference for every four to five turns. Winding was commenced from the bottom and the total wire length is 500,000 m. A special machine was developed running with rubber-tyred wheels on the wall of the base ring; the post-stressing and concrete spraying took 14 weeks. A total of one year was required to build the tank including foundation work. On completion it was filled with water from the local canal and withstood a 14-day test.—*W. Schmidt, Das Gas-und Wasserfach,* May, 1961, **102;** 509.

Sensitivity of wall-mounted gas equipment to wind

THERE has been a continued increase in popularity of domestic gas appliances mounted on an external wall which take their combustion air directly from out-of-doors and discharge their flue gases directly likewise.

These units are tested to DIN 3,364 and 3,365 which now lay down exact details of tests on the influence of outside wind conditions. An artificial wind is produced by a fan such that at 1.5 m. from the fan over a diameter of 500 mm. the air current must be 5 ±0.5 m. per second.

For this test, the Gaswärme-Institut, of Essen, uses a centrifugal fan with a butterfly valve in the intake and a divergent convergent extension piece on the fan discharge. This increases from 260 mm. to 600 mm. diameter over 400 mm., and then decreases to 430 mm. over 1,200 mm.: All pieces are coaxially conical.

Two horizontal and two vertical splitters at the narrowest cross-section and a wire mesh at the largest diameter make the air velocity uniform.

In this way external wall gas appliances can be tested for various directions of wind. The fan is mounted on a simple framework and can be arranged at any height and for an angle of up to 20° downwards. The heater being tested is mounted on a rotating platform; the test instruments are mounted separately from this platform.

This equipment has proved a useful extension to existing test equipment and has operated successfully.—*J. Becker. Gaswärme,* May, 1961, **10;** 193.

Gas pipe under a Venice canal

INCREASED consumption has necessitated an extension of the Venice gas-pipe network across the Guidecca at a point 318 m. wide. Since the Giudecca bridge carries considerable traffic, the only time when the crossing could be laid was during a religious festival. The one chosen was the Redentore Festival celebrating the Doge Alviso 1st (1592). Fortunately in 1960, this festival fell on July 17 when the tides had a variation of only 10 cm. over 10 hours.

In all, only 40 hours would be available for laying, necessitating the closest planning. All phases were closely tabulated for the laying of two pipes, including provision for any mishaps: A guarantee had been given that the service would be available for 1961. The crossing point was free from other services and a road at right angles to the shore would serve as a workshop. For safety the pipes were laid at minus 14.5 m. in the central 160 m. of navigable channel.

Ten days before laying, the bottom was dredged by the bucket dredger 'Francesco Morosini' providing a trench 8 m. wide and 2 m. deep and within this a second trench 4 m. by 2 m. deep: 8,000 cu.m. of silt were removed and carried out to sea. Natural gas piping of 159/146 mm. diameter delivered in random lengths of 11-13 m., were electrically welded, provided with protective coating of 1-cm. thickness and weighted to counteract buoyancy before launching. The protective coating chosen had been proved by six years' immersion in similar mud.

Since the street chosen for the workshop was only 250 m. long, each crossing required two pieces, and a weld had to be made, leak-tested, radiographed and coated during the launching; this was completed in less than two hours. A boat with a crew of two was placed at every 18 m. to control the pipe so that finally 18 boats were in position. The boats were provided with a marked rope for lowering and a pole for alignment; control from the H.Q. on the shore was by megaphone, radio, telephone or light signals in emergency.

The length of rope paid out by the boats was marked to maintain the correct curve of the pipe. After lowering the first pipe and checking with frogmen the second pipe was laid 1.5 to 2 m. alongside. The pipes were connected to prefabricated pipes at both ends and these were cast in molten pitch. The pipes are protected with magnesium cathodes and marked with a large board carrying the letter 'G.' All work was for, and under the control of, Officina Gas di Venezia. The article gives the exact timetable for all the work.—*F. Milesi, Gas,* April 1961, **11;** 126.

Separation of tar in electrostatic precipitators

THE DVGW (Institute of German Gas and Water Engineers) in Frankfurt has appointed a technical committee to survey gas-cleaning methods, and this article forms an interim report. The stages of deposition of tar are shown by the following typical figures:—

Coal throughput—1,000 tons per 24 hours.
Gas production—340,000 cu.m. per 24 hours.
Tar produced—35 tons per 24 hours.

Tar content in the gas per cu.m.:—

1. Main, 100
2. Entry to pre-cooler, 9-20
3. Exit from pre-cooler, 1-15
4. Outlet from compressor,
   (a) turbo compressor, .1-.2.
   (b) rotating piston compressor, 1-5.
5. Outlet from final cooler, .04-.03.

Thus even without an electrostatic precipitator 99.5% is removed, but with a rotating piston compressor the remaining tar may be ten times as much. A questionnaire of gasworks using horizontal chambers showed that in 65% of the cases the electrostatic precipitator, where used, was between the pre-cooler and the compressor, 17% between compressor and final cooler and 17% after the final cooler.

The compression of the gas may cause condensation in the final cooler particularly of naphthalene, if the temperature of the final cooler is not some degrees above that of the pre-cooler. From this there would seem to be some justification for having the precipitator after the final cooler. If it is placed after the pre-cooler and before the compressor the latter operates on clean gas.

Both these positions are technically correct. Since there is a temperature rise of up to 15° C. in the compressor the position directly behind the compressor is technically wrong.—*G. Choulat. Das Gas-und Wasserfach,* February, 1961, **102;** 129.

Minister gives go-ahead to methane proposals

NEWS SUPPLEMENT

THE Minister of Power has approved the Gas Council's plan for the importation of natural gas from the Sahara. This was announced in the Commons on Friday.

The Minister, Mr. Richard Wood, making his statement, said:

'In reaching this decision, I have taken into account the urgent need of the gas industry to reduce its costs of production; the technical advantages of methane; the comparatively small capital cost of this scheme; and the benefit it may bring our shipbuilding interests.

'I have also had regard to the effect of the proposals on the balance of payments, to security of supplies and to the objections which have been expressed by the National Coal Board.

'ADDITIONAL ENERGY'

'I am satisfied that my decision on the methane proposals will in no way prejudge the building of a large Lurgi plant if such a plant promises to be competitive. Nor will it prevent the industry from expanding its use of petroleum feedstocks.

'This scheme will develop a new technology and provide the country with an additional source of energy. It is not without risks, but I am convinced that they are outweighed by its merits.

'I agree with the view expressed in the Report of the Select Committee on the Nationalised Industries, that the gas industry should be enabled to take advantage of cheap supplies in order to strengthen its competitive position. I am confident that my decision will help it to do so.'

Answering a question, Mr. Wood said the effect on the coal industry was naturally one important matter which he took into consideration. 'I do not believe that this will affect the likely demand for coal more than to the marginal extent which was quoted in the Report of the Select Committee on the Nationalised Industries.

'ALTERNATIVE PLANS'

'I am satisfied that the supplies of town gas in this country could be safely and securely maintained whatever might happen in North Africa, because the gas industry has put before me alternative plans to deal with that eventuality.

'The plant and the mains in this country and the terminal necessary for the reception of this gas will cost about £18 million. The ships will not be a charge on the Gas Council, nor will the cost of the refrigeration plant in North Africa.'

Mr. Wood said he believed that the formation of the pipeline across the

country, which would be necessary because of these proposals, would facilitate the economics of a possible Lurgi plant in the future.

'What is absolutely true is that if these proposals had been refused the individual gas boards would have looked very favourably on a number of offers of liquid petroleum gases other than methane'

Mr. Wood told another questioner that he regarded it as his duty to try to allow the gas industry to be as efficient as it could be.

'DELIGHTED'

'The gas industry chose this method of proceeding in order to strengthen its competitive position and I think therefore, that I was right to agree to the proposal.'

At a Press conferende in Murdoch House the Chairman of the Gas Council, Sir Henry Jones, said they were delighted with the Minister's decision, which would eventually lead to lower costs of gas supply in Great Britain. This was something for which they were working all the time. Area boards should begin to show the effects for their financial year ending March 31, 1966.

Sir Henry could not say whether they would bring about actual reductions in the price of gas. What he could say was that, whether prices were lowered or not, gas would be cheaper with the scheme in operation than if it had not been put into effect.

The actual cost of town gas made from methane in the gasworks of area boards, which would have methane delivered by pipe, would be about 8½d. per therm at the gasworks.

The price delivered to gas consumers would be more, depending on the situation.

Sir Henry said that he felt sure the existing good relations which he enjoyed with the Chairman of the National Coal Board would not be endangered by the Minister's decision.

LORD ROBENS 'SURPRISED'

COMMENTING on the Minister's decision to allow imports of methane, Lord Robens, Chairman of the Coal Board, in a personal statement, said:

'I am greviously disappointed and considerably surprised that this decision has been made before it is known whether gas can be produced equally cheaply from British coal by the Lurgi process. The present study of this technique, being jointly made by the Coal Board and the Gas Council, should be completed within the next two or three months.

'I have every reason to believe that this examination will show that gas from the Lurgi process is competitive with imported methane.

'I welcome, therefore, the Minister's statement that his decision will not prevent the building of a Lurgi plant as advocated by the National Coal Board.'

Part of this methane would be used to enrich lean gas made from coal in the Coleshill Lurgi plant. On the other hand, the effect of this scheme on the use of coal by the gas industry would not be very large.

Sir Henry said: 'It is hoped that in about two-and-a-half years' time two specially constructed tankers will begin to operate conveying up to 354 mill. therms per annum to a terminal at Canvey Island, Essex, England. These deliveries are expected to provide about one-tenth of total gas supplies.

'The gas will flow through an existing main from Hassi R'Mel to Port Arzew, near Oran. There it will be liquefied in plant to be installed by C.A.M.E.L. (Compagnie Algerienne de Methane Liquide) an Algerian company owned 50% by Conch International Methane

Ltd., 26% by S.N.REPAL and C.F.P.(A) (the French Government controlled companies owning and producing the gas) and 24% by other French interests.] Then, at −258°F. and occupying only 1/600th of its original volume it will be transported in similar fashion to the cargoes carried by the Methane Pioneer. [The Methane Pioneer, a converted tanker owned jointly by the Gas Council and Conch International Methane, made a series of seven trial voyages from the Gulf of Mexico to Canvey Island between January 1959 and March 1960. On each trip a cargo of about 2,000 tons of liquid natural gas was carried and, after conversion by the North Thames Gas Board, was supplied to its consumers. This was the first time that such cargoes were carried across the ocean and the experiment was completely successful]'

He explained that the liquid methane will be stored in tanks to be built by the North Thames Gas Board near their existing tanks at Canvey, which would also be used.

It would then be pumped to regasification equipment, and after that transmitted through a new steel main laid for the purpose to at least seven of the 12 Area Gas Boards, i.e., North Thames, Eastern, South Eastern, Southern, East Midlands, West Midlands and North Western. Other Boards may also be supplied.

Each Board would be responsible for the section of the main to be laid in its own area.

INVESTMENT

The overall investment required by C.A.M.E.L. for the liquefaction plant and a jetty would be about £14 mill., while the harbour itself at Arzew was to be developed to make it suitable for large methane tankers.

The two tankers which would be required to transport the gas would each have a capacity of about 12,000 tons of liquid methane. Their service speed would be 17¼ knots.

Owing to the low specific gravity of the cargo (0.45 compared to water) their dimensions would be similar to those of a conventional 28,000 tonner, i.e., 610 ft. length overall and a beam of 80 ft.

These specialised vessels capable of carrying such an extremely low temperature cargo would be built to the design and specifications of Conch International Methane Ltd. (40% Royal Dutch Shell Group of Companies, 40% Continental Oil Company and 20% Union Stock Yard and Transit Company of Chicago).

Contracts for their construction would be closed shortly with Vickers Ltd. and Harland & Wolff Ltd., and the ships will be built at Barrow and Belfast respectively.

This order would provide valuable work for the British shipbuilding industry, the cost of the two vessels being about £7 mill. or more.

British Methane Ltd. would be responsible for the transportation of the liquid methane to Britain, and would charter the tankers on a long-term basis from two separate ship-owning companies:—One a U.K. subsidiary of Conch and the other—Methane Tanker Finance Company (Houlder Brothers Ltd.).

The vessels, which would fly the British flag, would be managed on behalf of British Methane Ltd. by expert British tanker operators.

TAR WILL HELP KEEP U.K. ROAD PROGRAMME UP-TO-DATE

—SIR HENRY JONES

THE task of laying new trunk roads was vital to the future development of the country and its status as a first-class Western civilised country, said Sir Henry Jones, President of the British Road Tar Association, at the annual dinner, last week. The function was held at Grosvenor House, Park Lane, London, W.1.

Sir Henry, who is also Chairman of the Gas Council, said that in the tar industry they believed they could play an extremely important part in the development of the Government's road programme, which was massive, although some of them believed it was not massive enough.

Tar was a good consideration for every kind of road and as an industry they believed that they could really help to bring the country up-to-date and keep it up-to-date.

He would hate to think that there was a chance of the United Kingdom becoming the sort of country which was looked upon by its neighbours as rather backward. He did not believe it would.

He referred to living standards in various other countries and said that if Britain was to hope to approach these standards there must be the best means of getting about the country.

Everyone was full of advice on how to run the gas industry and build roads and he would make a plea for a reassessment of traffic light timings so that we did not have risks that could be eliminated. Why could there not be an 'all-red' for a time? He believed it would be valuable to motorists and pedestrians.

He suggested that the country ought to have more international road signs.

Sir Henry made a plea for the roads to the sea, saying that, as an island people, he felt we required refreshing from the sprays and breezes at our coasts. So, he had a new slogan for the Minister—'If you want good health and transport builda mila roadaday.'

High quality

Mr. John Hay, M.P., Joint Parliamentary Secretary, Ministry of Transport, said they were extremely grateful to the Association at the Ministry for the work done and the high quality of the product with which they were concerned.

The Common Market project would mean that the country would have to be sure that industry was efficient and competitive and that, so far as it lay within the power of the Government, road and rail communications should be as effective as possible to enable goods to get from one part of the country to another and then overseas.

In 1960-61 expenditure on roads was £97 mill.; and on railways £162 mill., giving a total of £259 mill. invested. He had excluded from roads £85 mill. also spent on M. and M.1. In the current year it was estimated £110 mill. would be spent and about £145 mill. on railways, giving an estimated total of about £250 mill. This was 15% of the total capital investment. It was only one side of the picture. There was even greater investment by private individuals in transport. In 1960 that sector invested £392 mill. in transport, so that from all sources about £650 mill. was involved or 16% of the total capital investment in the country.

He did not think that 16% of total investment going into transport was a bad figure at all.

He thought they could claim they were all aware of the need for far-sighted and intelligent planning.

These were the three main things to be borne in mind:

1. Statement for a realistic number of years ahead of the lines on which they wished to progress.
2. They must allocate appropriate sums of money to meet commitments as projects went forward.
3. They must ensure continuity of work.

They had now set up organisations to deal with all these matters. They had to make right assessments as to the amount of public funds they could properly claim and divide the amount they got between the sectors.

SOMETHING COOKING AT DAIRY SHOW

THERE was always something cooking on the Gas Council's stand at the Dairy Show, Olympia.

Home Service Advisers from two Area Gas Boards—North Thames and South Eastern—were showing why two out of three British housewives cook by gas, with daily demonstrations in a model kitchen. Slices of meat, such as pork and veal, roasted on a spit, were offered to visitors to sample.

The preparation of small pastry dishes illustrated the use of controlled burners.

The demonstrations were held in co-operation with the British Farm Produce Council, which arranged a special display of food on the stand.

Of particular interest to farmers' wives was the wide range of gas cookers, refrigerators and water heaters. Three new space heaters were a feature of the exhibit.

Equipment in the model kitchen included a Radiation New World oven and hot-plate; an Electrolux refrigerator; a Servis Superheat washing machine; a Diplomat boiler and an Ascot water heater.

Course on cathodic protection

A VACATION course on 'Cathodic protection—instrumentation, interference and interference testing,' has been organised, with the co-operation of the Corrosion Group of the Society of Chemical Industry by the Department of Metallurgy, Battersea College of Technology, for December 19 and 20.

The course will cover the following aspects of the subject: Types of tests used in cathodic protection; instruments and characteristics of instruments; commissioning and maintenance instrumentation; special topics—half cells, redox potentials, constant potentials; interference—theoretical principles, interference in practice.

One lecture will be devoted to a survey of recent developments in this field. All lectures will be by specialists concerned with work in cathodic protection.

The fee for the course is £6, and enrolment forms and further information may be obtained from the Secretary (Metallurgy Courses), Battersea College of Technology, London, S.W.11.

Long-service awards were presented by Mr. Sydney Smith, Chairman of the Scottish Gas Board, recently, to 90 employees of the Board's Glasgow and Western Division. Their combined service totalled 2,450 years, and 25 had 40 years' service or more.

FUEL AND POWER FOR INDUSTRY EXHIBITION

The North Eastern Gas Board took part in the Northern Exhibition of Fuel and Power for Industry, held in Leeds from October 18-27. (See 'Gas in Industry,' *November 1, Page 248). In addition to the main stand, 100 ft. of space on one aisle was devoted to the various uses of gas and coke in industry. In this section exhibitors included F. H. Biddle Ltd., Powell Duffryn Heating Ltd., G. H. Langley Ltd. (textile engineers), and the Coke Dept. of the North Eastern Gas Board. The photographs show: Top—A general view of the North Eastern Gas Board stand. Left: A general view of the aisle devoted to uses of gas and coke in industry. The Coke Section is beyond the partition at the extreme left of the photograph. Right: The official party inspects the Board's stand after the opening ceremony. Left to right: Mr. Trevor Davey, Managing Director, Modern Exhibition Services Ltd.; Mr. J. C. George, M.P., Parliamentary Secretary to the Minister of Power, who performed the opening ceremony; the Lord Mayor of Leeds, Alderman P. A. Woodward; Mr. Norman Hudson, Commercial Manager, North Eastern Gas Board.*

Gas Council boosts SE-Duct flue system

THE construction of the tower blocks, ten, 20 or 30 storeys high, which are becoming so much a feature of modern urban landscapes, involves many technical problems.

One is the provision of satisfactory flues, and here recent developments in which the gas industry has taken a leading part, have attracted world-wide attention.

The introduction of the SE-Duct flue system simplifies the installation of gas heating and gas appliances in these multi-storey buildings, both domestic and commercial, and reduces costs, for one SE-Duct can perform the work of scores of ordinary flues.

The Gas Council brochure, 'Introducing the Remarkable SE-Duct Flue System,' available from Area Gas Boards, or from the Gas Council (price 2s. 4d.), explains the advantage of this method, with many examples and illustrations of its successful application.

Board lays 18-in. main under Surrey Docks

A SOUND engineering job has recently been completed successfully by the South Eastern Gas Board's Metropolitan Division Distribution Department. An 18-in. main has been laid across one of the entrances to the Port of London Authority Surrey Commercial Docks.

The whole project was surveyed, designed and carried out by distribution staff with the co-operation of the Port of London Authority's Divisional Engineer and the Dockmaster.

Getting an adequate gas supply from Rotherhithe holder station across to what is virtually an island formed by the Surrey Docks had been a problem for some years. The existing 10-in. and 8-in. mains, together with water mains, had been laid nearly 100 years ago in a specially constructed 3-ft. diameter cast iron culvert.

Difficult access

Since those days, however, electricity cables and Post Office cables have been laid, making access for inspection and maintenance virtually impossible.

In 1950, the various authorities approached the Port of London Authority with a view to constructing a new tunnel. A scheme was finally prepared to build a new culvert 7 ft. in diameter, but this proved too costly from the Board's point of view and an alternative was sought.

A preliminary survey of the site showed that close beside the inner lock gates there were recesses in the dock walls, on both sides, where some earlier lock gates had been housed. It was decided to re-route the 18-in. main in Rotherhithe Street, to cross the basin at this point, down one recess, across the bottom and up the recess on the other side.

The 18-in. steel loop, approximately 60 ft. long by 30 ft. deep, was fabricated on the site, with a 24-in. diameter 'blister' at the east side to form a syphon.

The welds were radiographically tested. The tube was painted with red lead mixture internally and protected externally with Metrotect enamel, reinforced with fibre glass, in accordance with the Board's specification.

The coating was Holiday detected and any defects made good on the site. The horizontal length of main which was to lie along the bottom, was coated with 2-in. thickness of reinforced concrete. The total weight of the steel loop was about 9 tons and the negative buoyancy when in the water about 2 tons.

The largest mobile crane in the country, a Lorain 65 ton crane with 75-ft. jib was used to lift the prefabricated steel loop. Specially made struts were used so that the loop kept its shape in the lifting.

The lowering of the loop into position went without a hitch and the main part of the operation was completed in three hours one sunny Saturday morning.

Sheet steel piling has been placed in front of the upright sections of the main to protect against possible damage by shipping going in and out of the basin, and the length of main along the bottom has been covered with concrete.

The ends of the loop have been connected to the 18-in. cast iron main on shore by insulated Johnson couplings, and valves have been inserted so that it can be isolated if necessary.

Cathodic protection has been applied to check corrosion and a concrete pit has been made to house the syphon pump.

New showroom

APPROVAL for conversion of premises at 42, Newmarket Street, Ayr, into a new showroom at a cost of £4,000, has been received by the Scottish Gas Board, Western District.

This development will give the Board improved facilities for promotional work in the centre of Ayr, which is the business centre for the South West Scotland area.

THREE STEPS TO SUCCESS

Three stages in the preparations to lay an 18-in. main across one of the entrances to the Surrey Commercial Docks (Port of London Authority). Top: The 18-in. steel loop being Gunited by Cement Proofing Co. Ltd., to a thickness of 2-in. Lower: The steel tubes being coated with Metrotect hot coal tar enamel and wrappings to South Eastern Gas Board specifications. Right: The steel loop being slewed ready for lowering into the Surrey Basin.

CORRESPONDENCE

APPOINTMENT ADVERTISED

DEAR SIR,

In response to protests which have been received, the Officers Side of the Senior Gas Officers Joint Council wishes to inform members of the constituent organisations represented on the Officers Side, that members cannot be recommended to apply for the post of Station Engineer at Dumbarton at a salary of £1,310 to £1,390 per annum.

The station engineer is responsible to the divisional production engineer for the production of gas and coke and for the supervision of two gasholder stations. The modern coal carbonisation plant makes about 2,100 mill. cu.ft. of gas annually.

The Officers Side considers, on the information before it, that the salary of the post is inadequate for the responsibilities devolving upon a suitably qualified and experienced engineer.

Yours faithfully,
J. R. W. ALEXANDER, Chairman,
G. W. PHILLIPS, Secretary,
Officers Side
Senior Gas Officers Joint Council.

COMING EVENTS

November 14. — MIDLAND JUNIORS: Staff Mess Room, Birmingham District, West Midlands Gas Board, Birmingham (Margaret Street entrance). 'Gas Governing,' by R. Hutchinson. 6.30 p.m.

November 16.—LONDON AND SOUTHERN JUNIORS: Visit to Thomas Potterton Ltd., Warwick.

November 16.—EAST MIDLANDS G.C.C.: Nottingham Chamber of Commerce, Smithy Row, Nottingham. 11 a.m.

November 20.—NORTH EASTERN G.C.C.

November 21.—GAS OFFICERS' GUILD: Church House, Great Smith Street, Westminster, London, S.W.1. Annual general meeting. 5 p.m.

November 23.—NORTHERN JUNIORS: Visit to the Sunderland works of the Northern Gas Board. 2.30 p.m.

November 25.—MANCHESTER DISTRICT JUNIORS: Cammell Lairds, Birkenhead. 'Experiences with Installing Warm Air Heating in Existing Houses,' by F. Eames.

November 27. — WEST MIDLANDS G.C.C.: Conference Room, Gas Offices, Edmund Street, Birmingham 3.

November 28.—I.G.E., LONDON AND SOUTHERN SECTION: 'The Use of Instruments in the Production and Distribution of Gas,' by J. R. Kenward. 2.45 p.m.

November 28.—THE COMBUSTION ENGINEERING ASSOCIATION, NORTH WESTERN REGION: Manchester. 'Liquid Petroleum Gas—the Present and Future Position in U.K.'

SCOTS NAME CHANGE

DEAR SIR,

Following your publication of my letter on the theme of the Scots name change and Mr. Clifford King's interesting comment, it was surely not unexpected to hear from David Fulton.

Mr. Fulton is of course right, there were other considerations, the issue being perhaps between remaining primarily a club—such as the Waverley—or to have a higher status. On this basis the result was obvious.

When Mr. Fulton says my father could not have envisaged the tremendous changes which have taken place in the industry, he is on much less certain ground. Precise crystal gazing 30 years ahead is not possible—it was my mother who had second sight—but I would refer Mr. Fulton to my father's presidential address at Alloa in April 1929, and entitled 'Co-ordination of Gas Supply in Scotland' in which it is clear that he did indeed forecast some of the changes which have only recently begun to take effect. It would take up too much of your valuable space to quote extracts from that address.

Mr. Fulton goes on to say that as a strong individualist my father would have intensely disliked many of the changes. In support of Scottish matters my father had no peer, although my memories of David Fulton are that he ranked close to him in such things. I can assure Mr. Fulton that well as he knew my father he is wrong in at least as many respects as he may be right.

Certainly in 1929 he realised that some governmental authority was necessary, and when the report recommending nationalisation was published, my father, I was not surprised to find from my many conversations with him over the years, endorsed it as a necessary measure.

My letter, Sir, was not to enhance my father's reputation—for me this would be foolish rather than filial—but rather to recall his foresight to those of the present day who may not realise that there is nothing new under the sun. I was also not writing in such a serious tone as may have been thought.

May I finish, therefore, in similar vein. I have happy memories of many meetings with David Fulton and perhaps none more vivid than a most enjoyable day in 1933 when I was his guest at Cardross Golf Club when it happened that under his watchful eye I performed agreeably well.

Yours faithfully,
J. W. NAPIER.

Purdis Rise,
Purdis Heath.
Ipswich.

LOWESTOFT GAS MAIN

DEAR SIR,

When the Eastern Gas Board team comes to mend the gas main fractured by quayside subsidence at Lowestoft, I wonder whether they will notice that it has already been repaired in exactly the same place?

The last occasion was about 20 years ago, the cause was a rather large bomb, and the consequences much the same as now—water and gas mains gone, the gas main flooded under the harbour, and the south part of the town gasless.

On that bleak occasion we tried all the pumps we had without success, and then called in the fire brigade, but the main stayed flooded. That was when we discovered that the depth of the main was greater than the theoretical lift in the atmosphere.

Enquiries about a submersible pump were not encouraging, the best offer being subject to some days delay. Our reputation was saved by our friend the borough surveyor, who offered us his mobile suction tank, normally used for emptying cesspools and the like.

In spite of our sceptical attitude the job was done in half an hour and we resumed the supply. I wonder whether the Eastern Gas Board included a cesspool emptier among its emergency equipment, or whether it is more fortunate than we were and can call up a submersible pump?

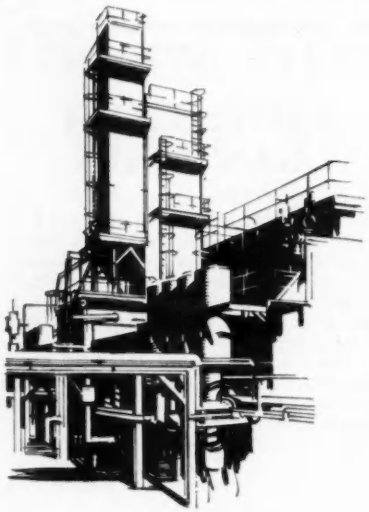
Yours faithfully,
W. H. JOHNSON.

38, Woodlands Road,
Cheltenham,
Glos.

PERSONAL NOTES

MR. A. J. PENSTON has been appointed to succeed MR. M. W. BURT as Director and Secretary of the Society of British Gas Industries when Mr. Burt retires on March 31 next year. Mr. Penston joined the Gas Research Board as assistant secretary in 1948, and became secretary in 1949. On the winding up of the Board in 1952 he was appointed an assistant secretary of the Gas Council, where his varied duties have included work on the commercial and by-products sides, home safety and refractories research, and special tasks as required by the deputy chairman of the Council.

MR. F. BRIAN HOLMES has retired as managing director of W. C. Holmes and Co. Ltd., but retains the position of Chairman. An item to this effect, carried under Personal Notes of last week, may possibly have been liable to misinterpretation.



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Classified Advertisements : All small classified advertisements are charged at 4/– per line (approx. 7 words)—minimum charge 12/– A Box Number address occupies 2 lines, and a further 1/- is charged toward cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's journal.

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